

Components of Effective Training

Dr. James W. Lussier

Mr. Scott B. Shadrick

U.S. Army Research Institute for the Behavioral and Social Sciences
Armored Forces Research Unit, DAPE-ARI-IK
121 Morand Street
Fort Knox, KY 40121-4141
USA

Tel 502-624-2613, Fax 502-624-8113

james.lussier@knox.army.mil
scott.shadrick@knox.army.mil

SUMMARY

When acquiring difficult skills it is useful to distinguish between ideal activities performed early in skill acquisition and those performed later. In this paper we distinguish the two as training and practice. Early on, activities ought to be designed to shape the manner in which the behavior is performed in order to insure that it occurs in an expert form. Later, activities are designed to make the behavior more automatic, i.e., less consciously controlled, to make it smoother, faster, or otherwise more effective, and to increase retention. The two types of activity are markedly different in structure, pace, amount and type of coaching required, composition of the training audience, focus of conscious attention, appropriate performance measures and feedback, and a variety of other characteristics. The distinction between training activities is important because a too rapid progression to the later type of activity – or skipping the first type of activity entirely – can be very inefficient with regard to acquisition rate and also tends to limit the level of expertise ultimately attained. The distinction applies not only to overt skilled sensorimotor behavior but also to cognitive behavior such as battle command decision making. Developers of today's high-technology simulation and training delivery systems, particular those characterized as virtual, typically strive to create high-fidelity practice environments which are not always suitable for the early and very important training activities. The paper describes the differences between effective training and practice. It discusses examples of successful applications designed for training complex skill related to battle command, and presents data comparing performance of Army leaders who acquired their skill through training and those who acquired it through experience, in this case, through deployments to Iraq or Afghanistan. Developers of advanced training delivery systems are urged to consider the two forms of skill development activity and provide features to support both.

INTRODUCTION

Providing suitable simulated environments for warfighters to perform battle command activities entails challenge and effort. In the past, it was clear that warfighters could only exercise in environments that did not respond to their actions in a way sufficiently similar to the way environments would respond in real operations. In many cases they barely responded to their actions at all. It was equally clear that the

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acquisition of battle command skills required not just study and knowledge but performance, that is, training and practice, and that the realism of the environments – the accuracy of their responses – had a great effect on the accuracy of the skills that developed. And so the construction of realistic performance environments was viewed as an important goal. Over the years, technology has been increasingly able to answer that challenge and – whether live, virtual, constructive, or some blurry combination – performance environments have increased in their complexity, detail, and responsiveness. But the effort that went into the creation of the exercise environments along with the necessary accompaniments such as scenarios and controllers and opposing forces so exhaust the resources of the training providers that the complementary and equally important work of providing effective and efficient training in the environment has been all but ignored.

As an illustration, consider that you decide to learn a new skill, for example skiing, and you hire an expensive ski instructor to teach you. Suppose the instructor takes you to a mountain and puts skis on your feet and simply tells you to go and ski all day. He says that at the end of the day he will meet you at the lodge and facilitate a discussion in which he will try to get you to bring out the strengths and weaknesses of your day's effort. Here you would instantly recognize his failing as an instructor and might even claim he was cheating you. Despite the fact that he had provided not just a realistic but an entirely real performance environment and also despite the fact that you undoubtedly would be improving somewhat through your efforts on the mountain, you would instantly recognize that you were not, in fact, receiving training. Why then, does a similar situation in the area of battle command training not evoke much in the way of complaint? Perhaps the evident truth that so much effort and so many resources go into the production of the simulated battlefield performance environment makes warfighters less likely to feel that there is more that could be done. Or perhaps one compares the environment to previous less realistic ones; in effect, the warfighters instantly see that they can acquire skill at skiing better on a real mountain faster than they can on a slanted floor. Perhaps they consider themselves already proficient, and so they have no need of instructors, only of practice, and so all they ask is for a realistic environment. Or perhaps the notion of training a cognitive skill like battle command in the same manner one would train other skilled behaviors is so foreign that no one expects such training. For whatever reason, it has seldom been noted that, when it comes to battle command, the opportunity to perform in a realistic environment is not the same thing as training.

Battle command is a mental activity of leaders conducting military operations. It requires the leaders to visualize the operation mentally, describe that visualization concisely and clearly to others, and direct the activity of those attempting to plan and execute the operation. Battle command is largely a cognitive activity and is distinguishable from the command and control system, a system of equipment, people, and procedures designed to support the leaders' battle command activity. This paper will attempt to make a case that the efficient acquisition of battle command skill requires a number of developmental activities including knowledge acquisition, training, practice, and experience. In particular, the paper will attempt to distinguish between the two activities referred to here as training and practice. The distinction will lead to a description of the components of effective training and how they are different from those of effective practice. Virtual environments for battle command (or any battle command performance environments) usually do a good job of supporting practice activities. Designers of virtual environments ought to consider how training activities, as well as practice activities can be supported. Finally, we will present some recent interim data from an ongoing experiment that provide some evidence of the positions presented.

DEVELOPMENT OF TACTICAL EXPERTISE

Four types of distinct activities that lead to the development of expertise in battle command can be described. In this paper, they are referred to as education, training, practice, and experience. Admittedly, the

common usage of those terms is not precise; they are frequently used in various overlapping ways and undoubtedly will continue to be used in that way. It is important, however, for those who wish to improve the ability of the U.S. Army to efficiently and reliably produce a large number of skilled professional leaders to understand the differences. And it is also worthwhile for those who build virtual performance environments to understand the difference between training and practice, a distinction that is not always appreciated.

Education: Experts must acquire a considerable body of knowledge. Technical and tactical knowledge is paramount, but knowledge from a wide range of allied fields, e.g., political, cultural, and economic, is also important. Education is not simply the accumulation of a set of facts but involves an integrated cognitive organization of those facts, encompassing, for example, complex relationships among various tactical entities. A solid military education that provides relevant, extensive, and readily available knowledge is necessary for effective tactical leaders, but it is not sufficient. Tactical leaders must be able to apply their knowledge to solve real-world problems and they must do so under the required operational performance conditions, which can be very stringent and demanding. Military historians, for example, often have an extensive military education and a strong understanding of tactical concepts, but they probably could not effectively command tactical units; they apply their tactical knowledge to do different tasks such as analyze historical engagements and derive principles of warfare from the analysis. Military commanders apply their tactical knowledge to understand the situations confronting them, to visualize potential future outcomes, formulate operational concepts, make decisions, describe their concepts to subordinates and superiors, direct the employment of their assets, and many other such tasks. These are behavioral actions – albeit many of them are cognitive behaviors – and knowledge alone is not sufficient to produce a skilled behavioral performance. For that, the following activities – training, practice, and experience – are vital.

Training: In training activities (as we are using the term in this paper), the learners engage in activities designed to accomplish some significant change in the way they perform a task – a change in the actual behaviors performed – to make the performance more effective or more in conformance with an expert's way of doing the task. Whether a cognitive or motor task, the primary purpose of training is to ensure that task is performed in a 'correct' or effective manner. Before training, the learners may have acquired knowledge about the task, that is, they understand the steps of task performance and the manner, order, reason, purpose, etc. of the process of task performance. For some simple tasks, this may be enough; knowledge of how to perform the task is sufficient to insure a skillful performance. For most tasks, however, training must go beyond understanding of the task performance steps and entail behavioral performance. The learners perform the task, often under the observation of a coach and not necessarily under fully realistic conditions, while consciously attending to the elements of task performance to verify that they are performing them correctly. Exemplar performances or demonstrations of how to do the task correctly can be very useful. Effective training is much easier to construct for procedural tasks and for other tasks where it is relatively simple to describe and measure correct performance than it is for more complex cognitive tasks such as those of tactical commanders and staffs. For example, it is easier to train procedures, e.g., the steps of military decision making process, than it is to train a staff officer to generate feasible courses of action or a commander to provide his staff with guidance that is useful, concise, and focused.

Practice: With practice activities, tasks are performed in the manner already known by the learners – they perform it in their usual way – but through repetition intend to ingrain the task, to make performance faster or smoother, to perform it under a variety of conditions, and to develop an ability to perform the task with little or no conscious attention, i.e., more automatically. Practice activities are particularly important in the development of expertise because performance of highly skilled tasks (including cognitive tasks such as battlefield visualization) requires that many activities be done simultaneously or in rapid coordination and with little conscious effort. The number of elements that can be consciously controlled is very limited, far

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fewer than the number of elements involved in most complex expert performances. Whether it is cognitive task such as recognizing battlefield situational patterns and identifying their associated actions or a perceptual-motor task such as landing a helicopter in a crosswind, experts rely on the automaticity that arises from repetitive practice under a range of representative conditions. In addition, practice activities contribute to overlearning, resulting in a decreased rate of skill decay.

Experience: Although it is not a part of the training research effort reported here, actual wartime experience is included as one of the key activities in the development of tactical command and staff expertise. In theory, one may suppose that a leader can be so well prepared by excellent education, training, and practice that he or she reaches expert proficiency levels without ever performing the task in a real environment. Still, it seems difficult to ascribe the designation of expert to someone with limited experience under real conditions despite the prevalence of high-fidelity simulation, well-instrumented live exercises, and authentic training experiences. A familiar saying goes: All but war is simulation. No matter how significant are the preparation activities incorporated in education, training, and practice, there are elements that cannot be adequately simulated, for example, the stress resulting from the high cost of failure, the psychology of sacrifice, and the ability to take calculated risks in decisions.

TRAINING AND PRACTICE

At first glance, training and practice appear to be similar activities in that they usually involve task performance under real or simulated conditions and because both are significant components in gaining proficiency. It is usually those two activities that are not clearly differentiated and those two terms – training and practice – that are normally used almost interchangeably. For example, when sports teams hold the activity called practice, there is much that occurs that we would call training, and when the Army conducts simulated tactical training exercises there is often much more of what we would call practice. Above, we have emphasized a distinction based on the purposes of the two activities. Training is designed to shape the manner in which the task is performed so that it occurs in an expert form; practice is designed to make the behavior more automatic, i.e., less consciously controlled – and make it smoother, faster, or otherwise more effective and to increase retention. Here we identify some other key and typical differences between the activities that support training and practice.

A key difference is where the learners place their conscious attention. Generally when experts perform they must rely heavily on an array of behavior that has become automatic, including habits of thought. Even relatively common movements like speaking a word require a great many coordinated movements of lip, tongue, diaphragm, etc. If you focus attention on one of these elements – for example try to deliberately control the tip of your tongue – it disrupts smooth expert performance. Moreover, in a challenging task, focusing conscious attention in the correct place is usually important. A baseball batter must focus attention on the pitch, on the delivery of the ball; if the batter is thinking about the alignment of his or her feet, then the quality of the performance is reduced – not because alignment of feet is not an important element, but because expert performance requires that attention be directed elsewhere and that the footwork element be automatic. In the same way, battle commanders must focus attention on the correct elements – monitoring ongoing events to achieve situational understanding and to detect the critical tactical features that require positive action – and must rely on the elements of thought and action that have become automatic from their previous training, practice, and experience. During training activities, when the purpose is to shape the manner in which the task is performed – the learner frequently focuses attention on an element of performance that will later come to be automatic, e.g., the batters focus on their feet to train expert footwork, even though outcomes are impaired, that is, they can't hit the ball very well when they are thinking of their

feet. This is perfectly appropriate and even necessary during training. After all, the purpose of training is to learn to perform the task correctly. During practice, however, when one wants to speed, ingrain, and perfect the performance, the learner will remove attention from many elements, trusting that they will retain their correct form based on frequent repetition during training activities. That is, during practice the manner of performance should resemble its final form.

Another way performance may be altered during training is to slow down the tempo. Activities occurring at a slower pace allow the learners to focus on how they are performing the elements. In practice activities, it is best to have a realistic tempo so that the manner of performance is not distorted by a too fast or too slow pace of events. Training activities tend to be part-task, simplified, and sometimes deliberately unrealistic to focus performance on the key elements. Fidelity of the environment is often counterproductive during training; learners can become too absorbed in the game, in winning the battle, in getting the best outcomes, and forget their training goals. Practice environments however should probably be as realistic and full-task as possible. Training is often better delivered in short, repetitive bursts. The same task is performed repetitively, perhaps systematically varying key variables. That structure allows for immediate repetition, so that if performance is flawed it can be corrected immediately – and performed correctly shortly afterward. Practice activities can be performed in short bursts also, but are more likely performed in long continuous actions which mimic the flow of actual events; actions are performed in context rather than repeated.

Coaching is an important part of training. A coach fulfills several important training functions. One is to instruct the learner on the correct way to perform the tasks; letting novices ‘figure it out’ for themselves – especially in so complex a field as battle command – is very inefficient; few will reach proficient levels of performance without quality instruction that provides process keys, that is, instruction that makes the processes used by successful tacticians fairly explicit. Another coaching function is to observe performance and note discrepancies from expert form to guide where the learners must focus their attention. Coaches discover areas of weakness in the learners and structure training activities to provide for appropriate performance. They point out correct performance as well, and try to insure the repetition necessary for the learners to develop automatic behaviors. Coaching is much less important in practice activities. The role of those who support practice activities switches from coach to observer/controller and their emphasis is on maintaining a realistic environment.

The type of feedback required varies between training and practice. With training it is very important to get process feedback that answers the question: Am I performing the task correctly? Thus the learner must be given feedback that compares his or her performance with the desired expert manner of performing the task. In contrast, process feedback is not so important during practice activities – it is assumed that the learner is performing the task correctly. Here, outcome feedback is most important – how effective is the performance in achieving its desired end. In training, however, outcome feedback is not necessary and, perhaps, should even be avoided. A number of training elements – recall the example of the baseball batters focusing on their footwork – can impair outcomes temporarily in order to achieve better outcomes later. A good illustration of the distinction in type of feedback is furnished by the example of a young taekwondo student learning to break boards with her feet. Initially the student performed the motions slowly, concentrating on her form, while the instructor provided process feedback, correcting the student’s movements. During this period of training, no actual boards were used. A focus on outcome at that time would have been counterproductive, forcing the student to neglect form in order to generate speed and power. When the student’s form was correct, real boards were used and she was able to break them. Afterward, she continued to practice her kicks, trying to ingrain the movements and build speed and coordination, but did not attempt to break any boards. Later when she attempted to break a board again, she was surprised that she could not do it. Her form had degenerated during the practice sessions. Had she used boards during the

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practice sessions, the outcome feedback (whether the boards broke) would have prevented the degeneration of her kicking form.

A difference which is sometimes noted (e.g., Ericsson, Krampe, & Tesch-Römer, 1993) is that training often feels like work – it is effortful. Realistic practice on the other hand may seem like play – one can lose oneself in the overall performance or game or exercise.

Good training is very difficult to conduct in large collective groups such as military training. Such characteristics as process feedback, coaching, and repetition are cumbersome to provide in the large group concept. Training is more conveniently delivered individually or in small groups. Practice on the other hand can be very efficiently delivered to collective units. Large-scale Army exercises sometimes provide some coaching to a few key members, but generally must be considered to be more suitable for practice than training. In such whole-task exercise environments, task events typically occur in their natural order and frequency. In more structured training environments, difficult, high-risk, low-frequency tasks such as responding to unusual crises can be an area of focus. Additionally, areas of personal weakness can be targeted for focused training. It should be noted that several of the distinctions noted above arise because of the tendency to conduct large-scale collective exercises – which we would denote as realistic practice – rather than from the strict definition of practice as an attempt to ingrain, speed, smoother or otherwise improve performance of a behavior. Practice can also be deliberate, repetitive, focused, and structured. In the U.S. Army, however, battle command practice is typically achieved through large-scale exercises, and the training phase (as we have defined it) is largely neglected. Officers acquire tactical and technical knowledge then go directly to practice exercises and operational experience with little or no structured training in battle command. By this rather lengthy contrast of training and practice, we hope that the difference between the two activities is clear; the differences are summarized in Figure 1. The next section will emphasize the importance of the distinction.

Training	Practice
Changes form of behavior	Makes behavior more automatic & effective
Conscious attention on own performance	Conscious attention on external situation
Slower tempo	Realistic tempo
Part-Task	Full-Task
Short segments with immediate repetition	Long continuous performance
Coaching vital	Coaching not necessary
Process feedback required	Outcome feedback required
Realism less important	Realism very important
Suited to individual/small group exercises	Suited to large-scale collective exercises
Explicit description of process important	Descriptions not required
Concentration on difficult and high-risk tasks and on areas of personal weakness	Tasks occur with natural frequency
Systematically varied conditions	Realistically varied conditions
Usually feels like work	Sometimes feels like play

Figure 1: Several Key Distinctions between Training and Practice.

PRACTICE WITHOUT TRAINING

Practice without training or with insufficient amounts of effective training (probably not very different from what has been termed discovery learning) is neither an efficient nor ultimately effective method. In most complex fields, for example, the relationship between performance levels and amount of practice is reliably strong only when considering the novice phase of skill development. That is, when one is a rank beginner, simple performance in a realistic environment (which we have termed practice) or, in fact, in a real environment (which we have termed experience) will usually lead to improvements in skill. At some point, however, performance no longer improves. The person may continue with large amounts of practice and experience but does not get any better. For example, it has been estimated that amateur golfers (who engage in limited training but much practice and experience) will improve their scores for about two years and then show little or no performance gains even though continue to play the game for decades. The same is true of most other areas in which expertise is measurable. In chess playing, where there is a reliable performance-based measurement system, the initial rise may be a bit longer (four or five years) but at the end of that time there is generally no further measurable improvement until a decline sets in with advancing age. Other good examples are handwriting, driving, typing, and (I would like to add) thinking – we typically perform these behaviors a lot after we leave the novice stage, but without notable gains in performance quality. The essential point is: experience does not by itself lead to expertise. In many fields, beginners rise rapidly in skill and may, after a few days, a few months, or a few years, depending upon the nature of the domain, surpass very experienced ‘old hands.’

For example, in chess, most amateur U.S. tournament players do not ever rise above the average United States Chess Federation rating of C player despite a lifetime of playing experience which provides extensive practice with clear outcome feedback, while many higher-rated players (A, B, Expert, and Master ratings) can be very young and comparatively less experienced. Typically, quality training and strong coaching can raise the performance even of highly experienced performers, although presumably the more ingrained behaviors are, the more resistant they are to change. Tiger Woods, the best golfer in the world, got a new instructor and changed his swing to make it more reliable. It took about a year and a half for the new swing to take hold, but eventually it started showing results. Most people, however, are very loathe to get worse temporarily in order to possibly get better later. While we emphasize the importance of training we do not intend to slight the significance of practice. In the development of expertise in almost every field, training without sufficient practice produces as poor a result as practice without sufficient training.

The relationship between knowledge, training, practice, & experience is complicated and depends to a great extent on characteristics of the domain: How important is an underlying body of knowledge to performance? Is it one that perhaps takes years to accumulate? To what extent are inherent talents and physical or cognitive abilities a factor? Has an organized body of ‘how-to-perform’ or ‘how-to-train’ content developed, perhaps over generations of practitioners? Each of these questions briefly will be addressed briefly with regard to the battle command domain.

For the military domain, there is clearly a considerable amount of necessary knowledge, lack of which cannot be overcome by superior intelligence or leadership skills. And it is a constantly changing body of knowledge. The capabilities of weapon system and information systems, the enemy’s tactics, the strategic setting, the nature of war itself – all of these fundamental factors seem to be particularly in flux at present, notions that are embodied in such terms as Contemporary Operational Environment and Transformation to the Future Force. For commanders and staff, however, the knowledge component is necessary but not sufficient to enable expert performance under demanding battlefield conditions; they must develop and maintain a current knowledge base, but also must engage in the training, practice, and experience that will allow them to

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apply that knowledge skillfully to solve complex problems rapidly under pressure. An extensive knowledge base without the training and practice neglects the behavioral component – they are able to talk knowledgeably about warfighting, but cannot perform adequately. Most officers, we would maintain, (and of course others might argue the opinion) do develop a fairly large knowledge base through the Army's institutional schooling system, through their experiences in units, and by independent study of their profession. The U.S. Army rarely provides deliberate training in how to skillfully apply that knowledge, and even good practice opportunities such as Combat Training Center rotations are relatively few in a career. In our opinion, it is not knowledge acquisition – important as that is – that is the rate-limiting factor on the development of expertise in U.S. Army Commanders. The greatest payoff for accelerating the development of young officers lies in deliberate training in battle command.

When it comes to applying knowledge, in some domains knowledge of the performance steps alone is paramount. In highly proceduralized fields, for example, if you know how to perform the task – the steps and procedures - that is all there is to it. Everyone who performs the right tasks in the right order will have equally successful results. In other domains knowledge of the steps is elementary; the key question is how skillfully the steps are performed. Command and control of tactical operations falls into the latter type of activity – knowing the steps of the military decision making process (MDMP) is elementary. What is difficult is providing good clear focused commander's guidance that is on target, generating feasible courses of action rapidly, thoroughly wargaming the courses of action so that a well-synchronized plan results. In other words, the important factor is how well each action is performed. Knowledge of the MDMP steps doesn't help one perform them skillfully – that takes training. And it takes considerable practice to perform the tasks rapidly while confronting unique challenges and demanding conditions.

To what extent are inherent talents and physical or cognitive abilities a factor? The question is worth mentioning, although it is difficult to answer. Clearly, for cognitively and physically challenging command and control operations, inherent abilities must be significant. If they were of overriding importance then the Army would need to focus more on selection than training. Probably, however, they are not. There are some few officers who will develop expertise on their own. Without systematic training they are able to take lessons from practice opportunities and experience. Others, at the lower end, probably will not attain adequate levels of expertise despite the best training and practice. The challenge facing the Army is to raise the level of performance of the majority of officers in the middle, to do so rapidly and efficiently, and to do it prior to deployment into actual operations. In the current environment, the answer seems to lie more in meeting the training challenge than the selection challenge.

A THEME-BASED TRAINING METHOD FOR BATTLE COMMAND SKILLS

Previously it was suggested that the notion of training a cognitive skill like battle command in the same manner one would train other skilled behaviors was so foreign that no one expected such training. A number of years ago, the same could be said of chess. For decades, the Soviet chess machine produced a stream of grandmasters that thoroughly dominated all competition. Not only did they hold a virtual lock on the world championship (except for Bobby Fischer), but they had great depth on their bench. There were dozens of Soviet grandmasters at world class caliber, while most nations could show one or two at the most. Chess players around the world assumed the Soviets achieved their success solely by extra effort in selecting, developing, and supporting promising players. But did the Soviets have some new and secret training methods that the rest of the world did not? No, no one imagined that. With the breakup of the USSR, Soviet chess academies became publishing houses. The release of such books as Alexander Kotov's *Think Like a Grandmaster* and Mark Dvoretsky's *Secrets of Chess Training* stunned the chess world as it discovered that

indeed the Soviets did have methods they had kept secret. The key to the Soviet methods is that they trained the thinking processes of their students. The rest of the world studied the game of chess, its strategies and tactics, and tried to understand why one move was better than another and then they played a lot of games, both practice games and tournament games. In other words, the rest of the world acquired knowledge, practiced, and gained playing experience, but they did not actually train the skills. The Soviets studied the human processes of finding good moves and avoiding errors, of searching and evaluating chess positions, and of controlling emotion and fighting the psychological battle with one's opponent. They described principles of expert play which reflected the thought patterns of grandmasters. While many of these expert principles were familiar to the rest of the world, the Soviet trainers went one critical step further. They created exercises that trained these principles, ingraining them in their students. *In short, the Soviets identified expert thought patterns - the cognitive behaviors displayed by top grandmasters - and then they deliberately trained those behaviors.* The Soviet students employed the expert thought patterns not simply because they understood the principles nor because they were following a remembered checklist. The behaviors had become automatic. As a result of the exercises, the students followed the principles without thinking about them, freeing their limited conscious resources to focus on the novel aspects of the contest and to think more deeply and creatively at the board. Thus, the Soviets had developed a number of training techniques for chess that incorporated many of the features of training described above.

In recent years ARI has applied a similar strategy to deliberately train several complex cognitive skills – skills that had previously been left to Army officers to acquire through experience. The first application, called Think Like a Commander, trained adaptive thinking in tactical situations at the company command level. ARI also conducted research with vignettes at the battalion and brigade command level. Think Like a Commander was followed by two other applications using the theme-based deliberate training. Army Green is a platoon leader training package that focuses on reacting to unexpected events of a non-tactical nature, a significant challenge to young Army leaders. The third application is called Red Cape and involves training the Army National Guard to interoperate with a large number of government agencies in crisis action planning and execution, such as in a terrorist attack. The development of the interagency training package was conducted in the State of Indiana and involved several agencies involved include the Army National Guard, the Department of Homeland Security (formerly State Emergency Management Agency), the Department of Transportation, the Department of Environmental Management, the Department of Agriculture, the Transportation Security Administration, the State Civilian Support Team, and several city and county fire, police, and emergency medical agencies.

The general structure of the training method will now be described. The key step is to develop a list of what are called themes – they are cognitive behaviors, i.e., patterns of thought, that are characteristic of experts in the performance of the task at hand. In our applications we have used about 8-10 themes. As examples, some themes of tactical thinking are Model a Thinking Enemy and Consider Timing Explicitly, some themes of Army Green for new platoon leaders are Be Consistent and Know your Soldiers and some themes of Red Cape for interagency crisis planning and execution are Maintain Focus on Mission Priorities and Plan for and Recognize Decision (Trigger) Points. The themes need to be behavioral, albeit cognitive behaviors, that are at the right level of generality – neither too general nor too specific. By way of illustration, a very general thinking skill, which is applicable to a wide variety of situations, could be phrased “take a different perspective.” A more specific instance, tailored to battlefield situations would be embodied in a rule such as “if the enemy does something you didn’t expect, ask yourself what purpose he hopes to achieve by the act,” a behavior that inclines one to take the enemy perspective. A yet more specific instance would be “when you see an enemy-emplaced obstacle, ask yourself why he put it in that exact location and what he intends to achieve by it.” Recall that these thought acts – these cognitive behaviors – are not part of a large checklist that one continually seeks to proactively apply to the environment, rather they are thought habits that operate

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within complex structures (i.e., mental models) and must be triggered by some stimulus event. When the triggering event is very specific and identifiable such as an enemy-emplaced obstacle the training may proceed readily but has a limited applicability. Achieving the desired effect of improving adaptive thinking in tactical situations would require an enormous number of such habits be trained. At the other end of the spectrum, the mandate to “take a different perspective” is so vaguely triggered and the act of taking the different perspective so broadly flexible that a tremendous and thoroughgoing training effort must be required to achieve any lasting effect, especially when one considers the attention-demanding and focus-narrowing environment in which we seek to affect behavior. Thus, we believe the course taken in this effort to be the most efficacious one; to place the themes at just such a level of generality that they represent thinking behaviors that are as specific as possible while remaining relatively consistent over a wide range of tactical situations. Because of that consistency, the formation of automatic thought habits will occur more quickly, and because of the specificity they will more likely operate in the desired conditions.

Once the behaviors to be trained are identified, training can proceed efficiently using well-established principles of training. Specific problem cases are presented, learners are asked to perform and record their solutions, instructors demonstrate appropriate thought patterns, students score themselves against prepared expert responses, and the process is repeated until student performance levels increase.

The theme-based training method, unusual in that it intends to deliberately train cognitive as opposed to sensorimotor behaviors, has been extraordinarily successful. It has been rapidly taken up by U.S. Army schools and units, including the U.S. Army Armor School, which provides training to officers deployed to Iraq and Afghanistan and other locations through a synchronous web-based medium and has received very positive feedback from participants and instructors. Most significantly, it has produced surprisingly strong performance gains as measured by the ability of Army officers to identify significant features of complex tactical situations under increasingly severe time constraints.

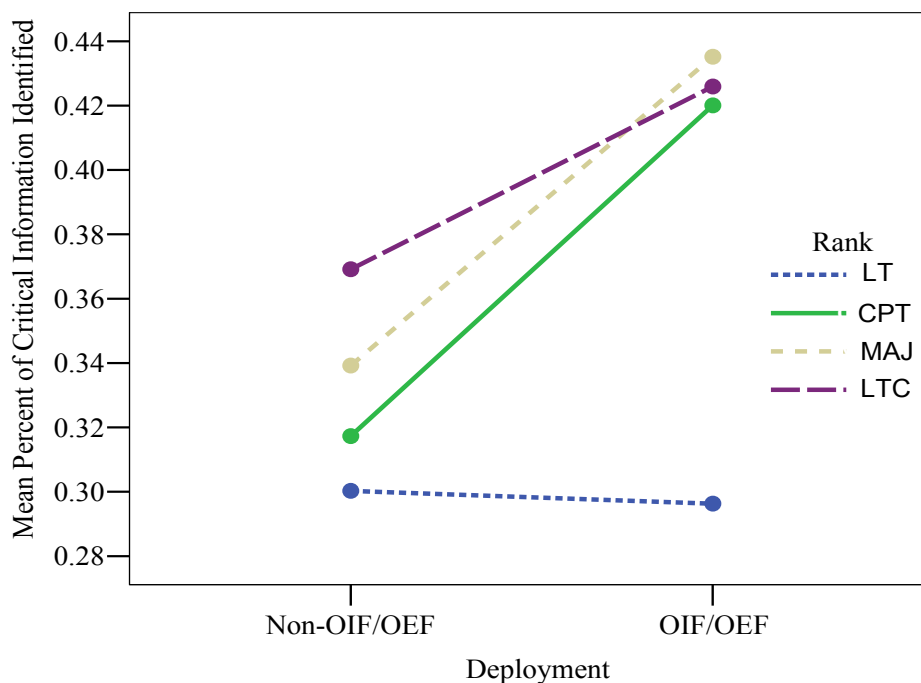


Figure 2: Mean Percent of Critical Information Identified for each Rank by Deployment.

Some recent data provide validation for our training and our measurement method. One-hundred and eighteen U.S. Army officers (lieutenant thru lieutenant colonel) were presented with three challenging and dynamic problems and had to rapidly identify all the relevant tactical considerations. None of the 118 officers had received the Think Like a Commander training. The results, shown in Figure 2, reflect the percentage of a master list of expert considerations that the officers were able to identify in the time limit. Officers with deployments to Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) performed significantly better on the adaptive thinking task. The data support recent reports (e.g., Wong, 2004) that suggest that events in OIF and OEF are contributing to the development of agile, adaptive leaders. Performance differences were also obtained for officers of various levels of rank. In examining results for non-deployed officers, the results clearly demonstrated that performance on the adaptive thinking task increased with higher rank. The results for deployed officers demonstrated performance improvement for deployed captains, majors, and lieutenant colonels. Further, the results showed that the performance of deployed captains and majors converged with that of the lieutenant colonels. The analysis revealed that there was no difference in performance between deployed and non-deployed lieutenants.

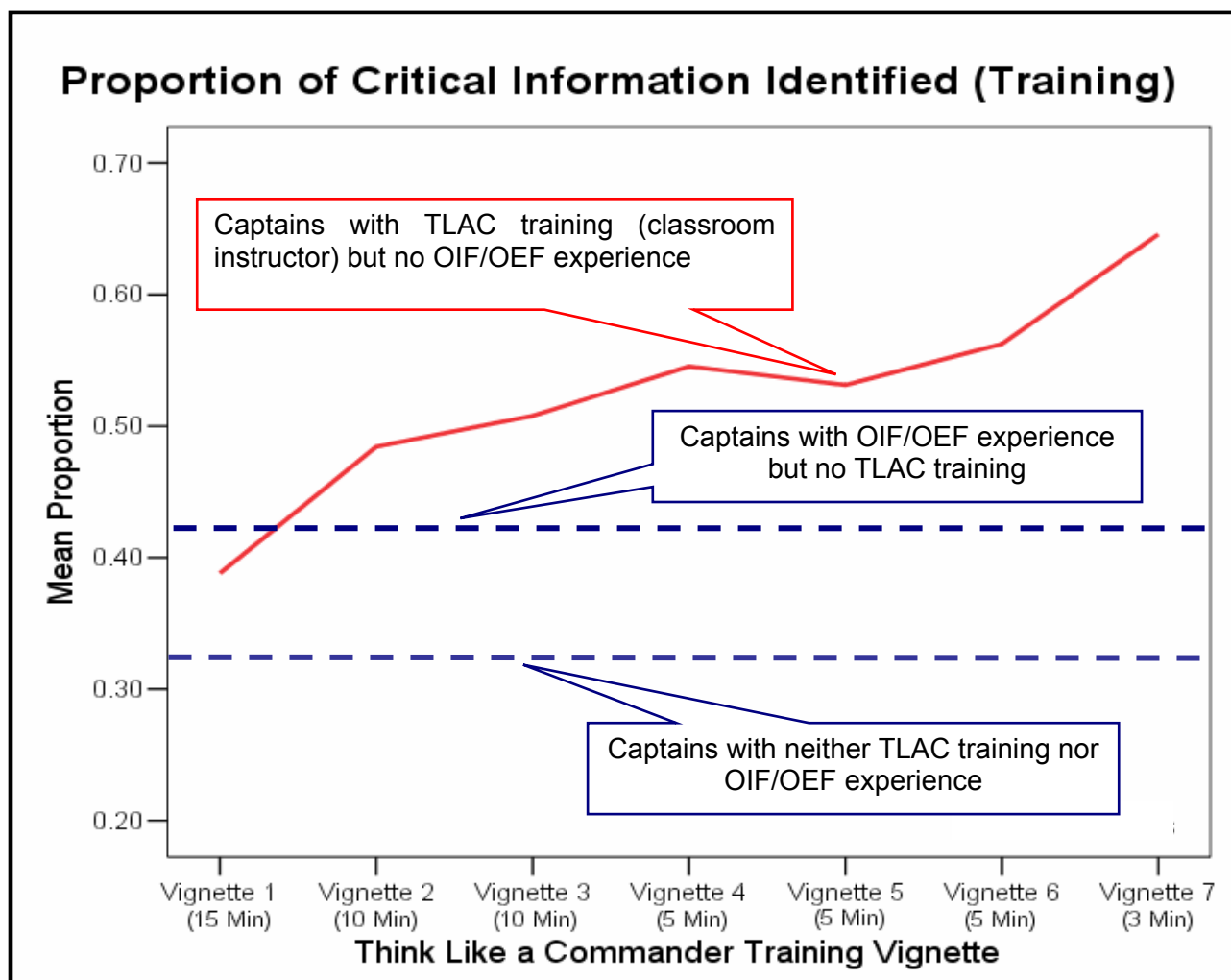


Figure 3: Illustration of the Value of Adaptive Thinking Training for Captains.

Components of Effective Training

However, what is also particularly relevant (See figure 3.) is that when captains with OIF/OEF experience but no Think Like a Commander training are compared with captains with Think Like a Commander training but no OIF or OEF deployment experience on a series of vignettes, the scores looked to be the same initially. Continued training led to substantially higher performance scores. In fact, the captains with our training (who had not been deployed in either OIF or OEF) outscored even lieutenant colonels with OIF/OEF deployment but no adaptive thinking training. Further, note that we are comparing the effects of approximately 10 hours of training to those of an entire deployment. Of course the deployed officers undoubtedly learned a lot of other things during the deployment. Still, the data are evidence of accelerated learning of this difficult-to-train skill, and, of course, providing a relatively brief course of training prior to deployment that results in performance levels equal or better than those who return from deployment is greatly preferable to acquiring the skill in a dangerous environment. The main point is that the experiential learning in a realistic or even a real environment can be very slow compared to deliberate focused training such as Think Like a Commander and, moreover, may ultimately result in lower performance levels. We believe the finding extends to a wide variety of cognitive skills. Whether judged by rate of acquisition or ultimate level of expertise achieved, training methods exist that greatly outperform the more commonly employed methods relying on knowledge acquisition followed by realistic practice. The key involves an appreciation of the difference between training and practice and a path to expertise characterized by early training that shifts to practice activities as greater expertise develops.

CONCLUSION

In this paper we tried to make the case that the requirements for activities early in the process of skill acquisition are different from those later in the skill acquisition process. We argue that the training phase – intermediate between acquiring relevant knowledge and practicing in a realistic environment – is very important to the rate of acquisition and ultimate level of expertise obtained. We also argued that this conclusion applies to cognitive skills as much as it does to more overtly behavioral skills. We presented evidence for a complex cognitive battle command skill that indicated that small amounts of deliberate theme-based training can produce performance levels equal to or better than those found after a year of actual operational experience. The designers of virtual training systems are urged to consider how well their systems will support the components of effective training as opposed to merely providing realistic practice environments.

REFERENCES

- Ericsson, K. A., Krampe, R., & Tesch-Römer, C. (1993). The Role of Deliberate Practice in the Acquisition of Expert Performance. *Psychological Review*, 100, (3), 363-406.
- Shadrick, S. B., Fultz, C., & Lussier, J. W. (in preparation). *Measurement of Adaptive Thinking Gains in Operation Iraqi Freedom And Operation Enduring Freedom Leaders*. (ARI Research Report) Alexandria, VA: U.S. Army Research Institute for the Behavior and Social Sciences.
- Wong, L. (2004). *Developing adaptive leaders: The crucible experience of Operation Iraqi Freedom*. Carlisle Barracks, PA: Strategic Studies Institute of the U.S. Army War College.



US Army Research Institute

COMPONENTS OF EFFECTIVE TRAINING

Dr. James Lussier
Mr. Scott Shadrick

“Virtual Media for Military Applications”

13 JUN 2006

Introduction

- Battle Command versus Command and Control
- Battle Command Thinking is a Behavior
 - Hard to acquire expertise because not procedural
 - Hard to coach because not observable
- The Bad Ski Instructor

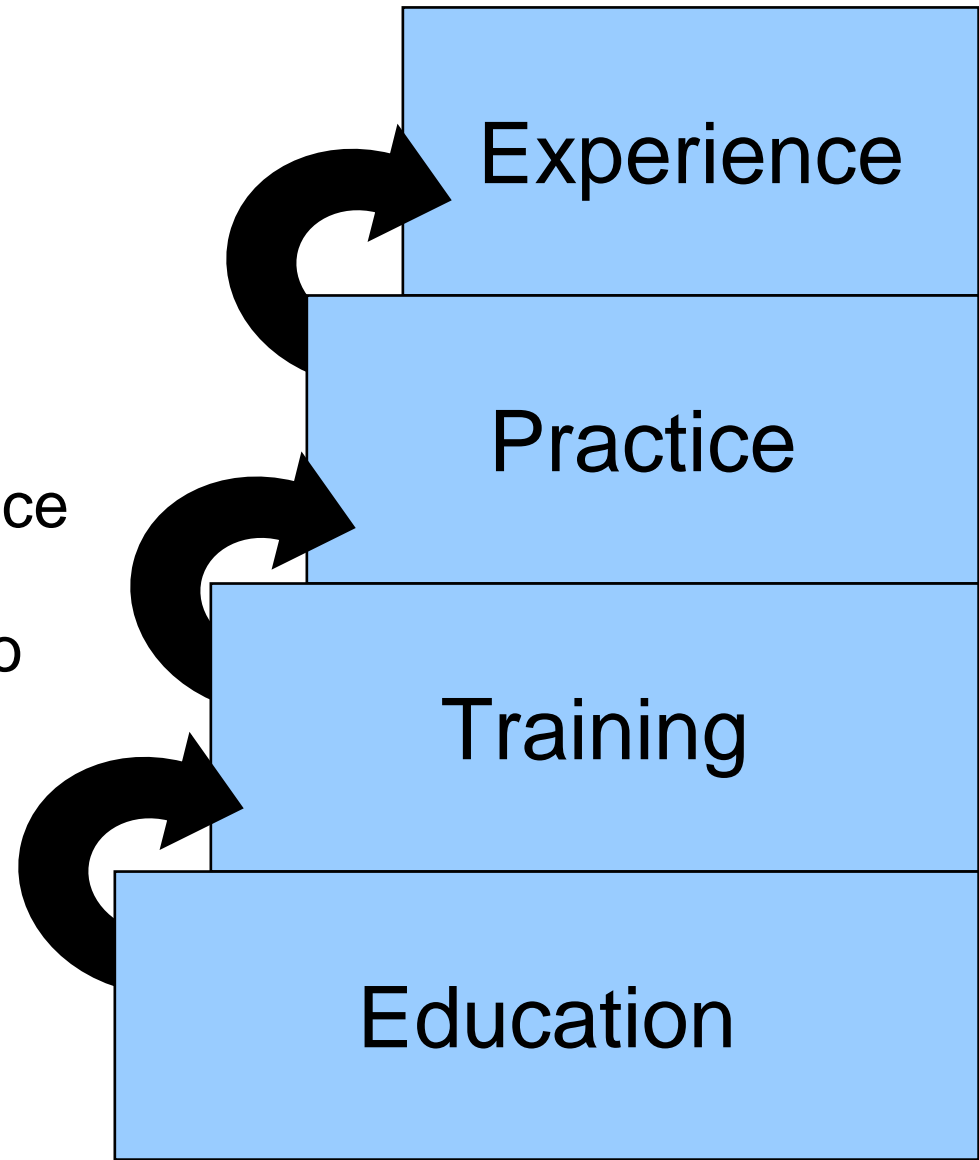
Activities in the Development of Expertise

Perform for real under actual conditions and consequences

Perform under a variety of conditions for faster, smoother, and more automatic performance

Change the form of behavior so that it conforms to an expert's manner of performance

Acquire knowledge and a conceptual understanding of the domain



Differences between Training and Practice (1 of 3)

	Training	Practice
Purpose	Change form of behavior	Make behavior more automatic & effective
Conscious attention is on:	Own performance	External situation
Tempo	Slower	Realistic
Context	Part-Task	Full-Task
Timing	Short segments with immediate repetition	Long continuous performance

Differences between Training and Practice (2 of 3)

	Training	Practice
Coaching	Very important	Not important
Feedback	Process	Outcome
Realism	Less important	Very important
Participants	Individual & small group exercises	Large-scale collective exercises

Differences between Training and Practice (3 of 3)

	Training	Practice
Explicit description of process	Very important	Not required
Frequency of situations	Concentration on difficult and high-risk situations and on areas of personal weakness	Situations occur with natural frequency
Conditions	Systematically varied	Realistically varied
Affect and effort	Usually feels like work	Sometimes feels like play

Practice without Training

- Training is important ...
even for complex cognitive skills such as
battlefield adaptive thinking, i.e., rapid domain-
specific problem solving
- Practice without training is ineffective
 - lower rates of acquisition
 - lower ultimate levels of performance
- Skipping explanation of how to overcome the
challenge of training cognitive behaviors

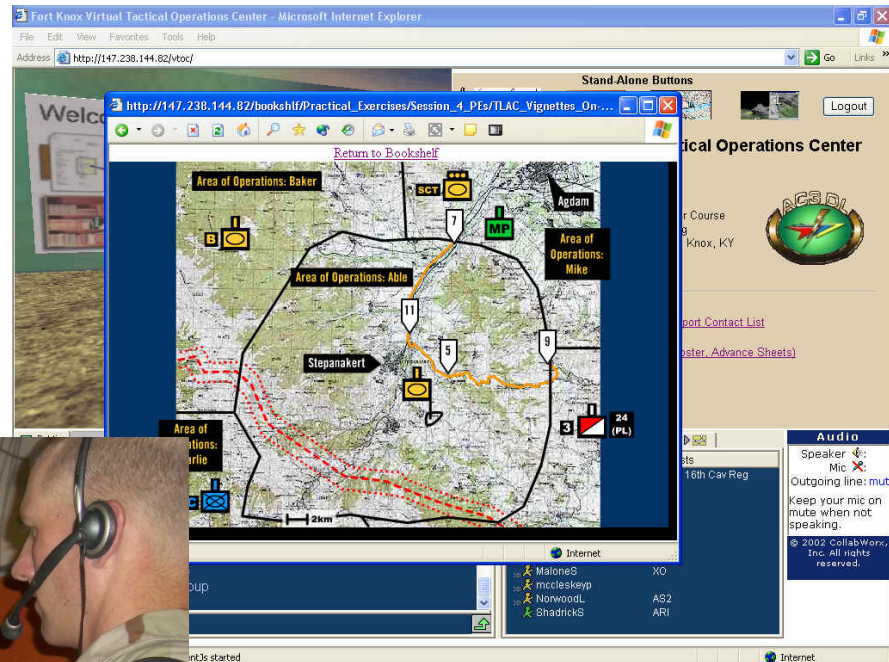
Think Like a Commander - Classroom

Live instructor
with small group
instruction



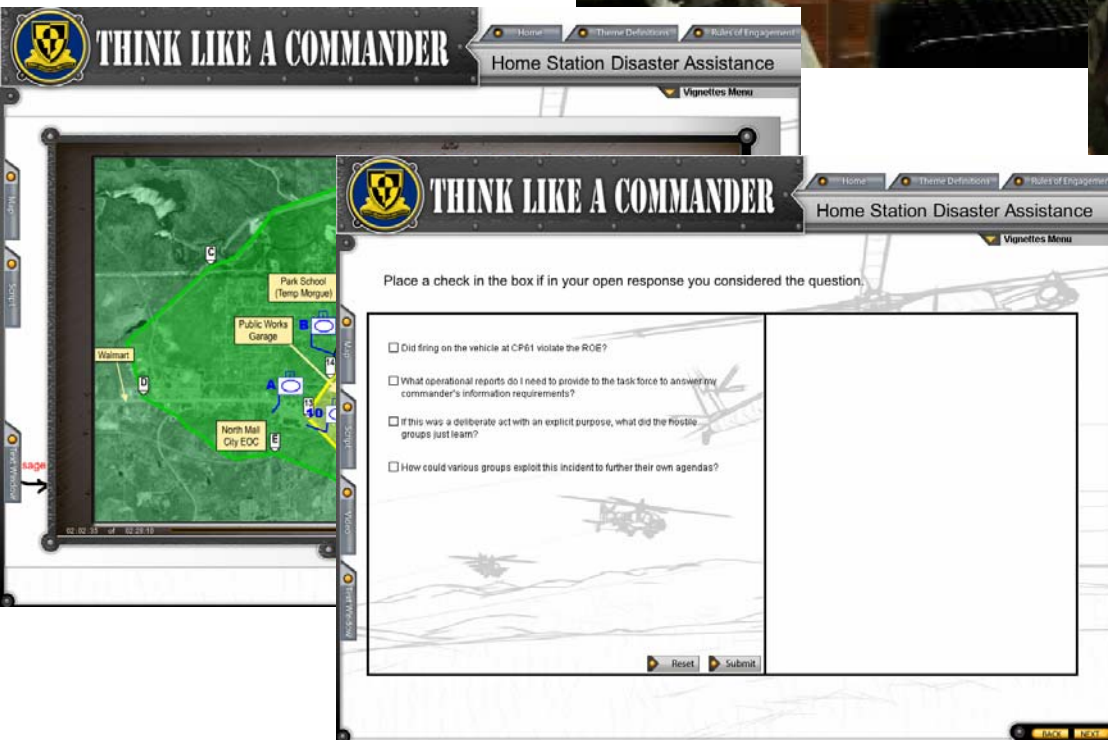
Think Like a Commander - Distributed

Live instructor on
a collaborative
network



Think Like a Commander - Instructorless

Automated Coach

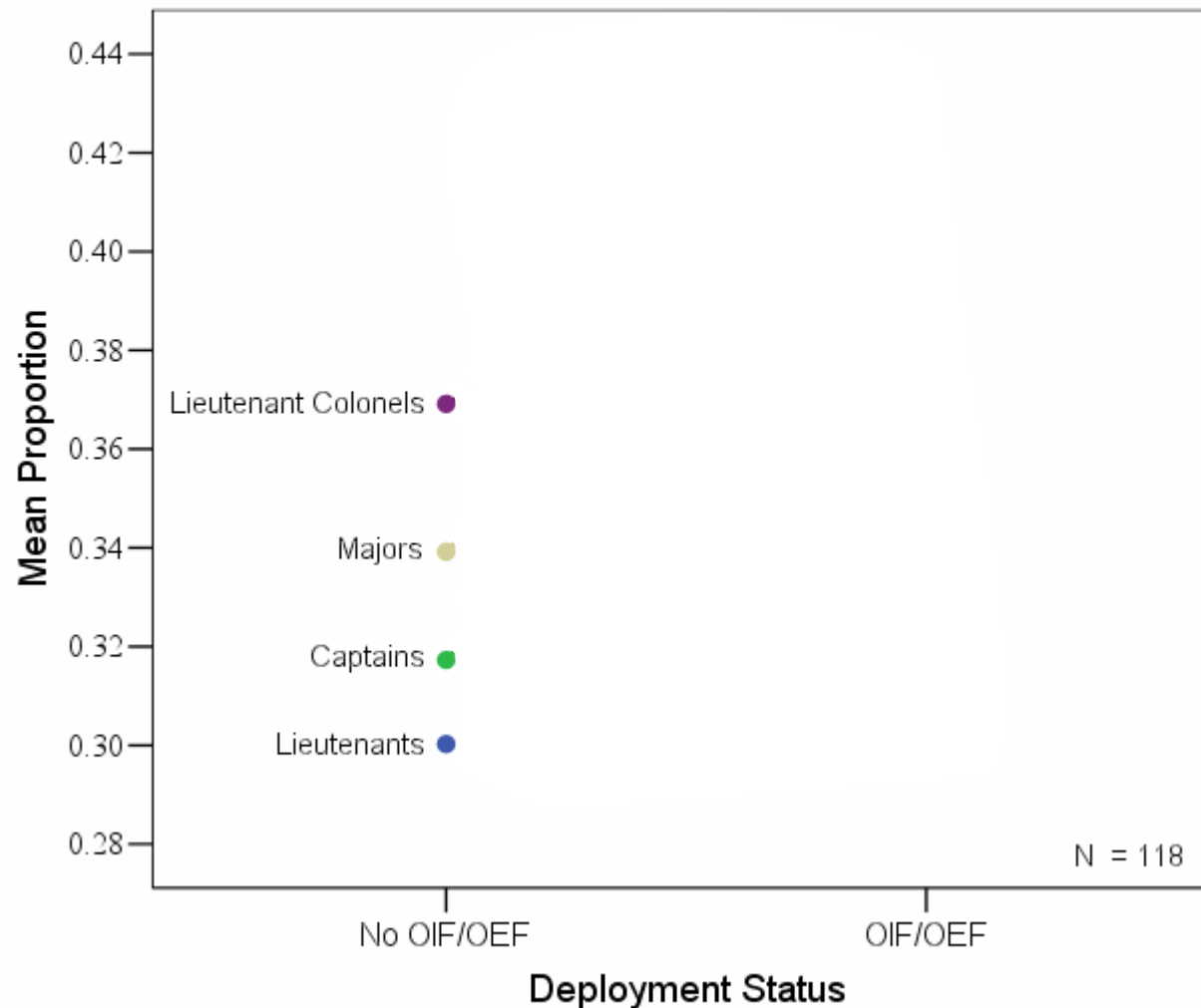


Measurement of Adaptive Thinking Skill

- **Measurement involves a series of situational judgment tests involving tactical situations ranging from stability and reconstruction to high intensity combat operations.**
- **Participants must rapidly (10 min. time limit) size up tactical situations and identify critical factors.**
- **Scored against an expert-generated list of key considerations of the tactical situation.**
- **Participants include 118 U.S. Army officers of various ranks, about half with OIF/OEF deployment experience.**

Measurement of Adaptive Thinking

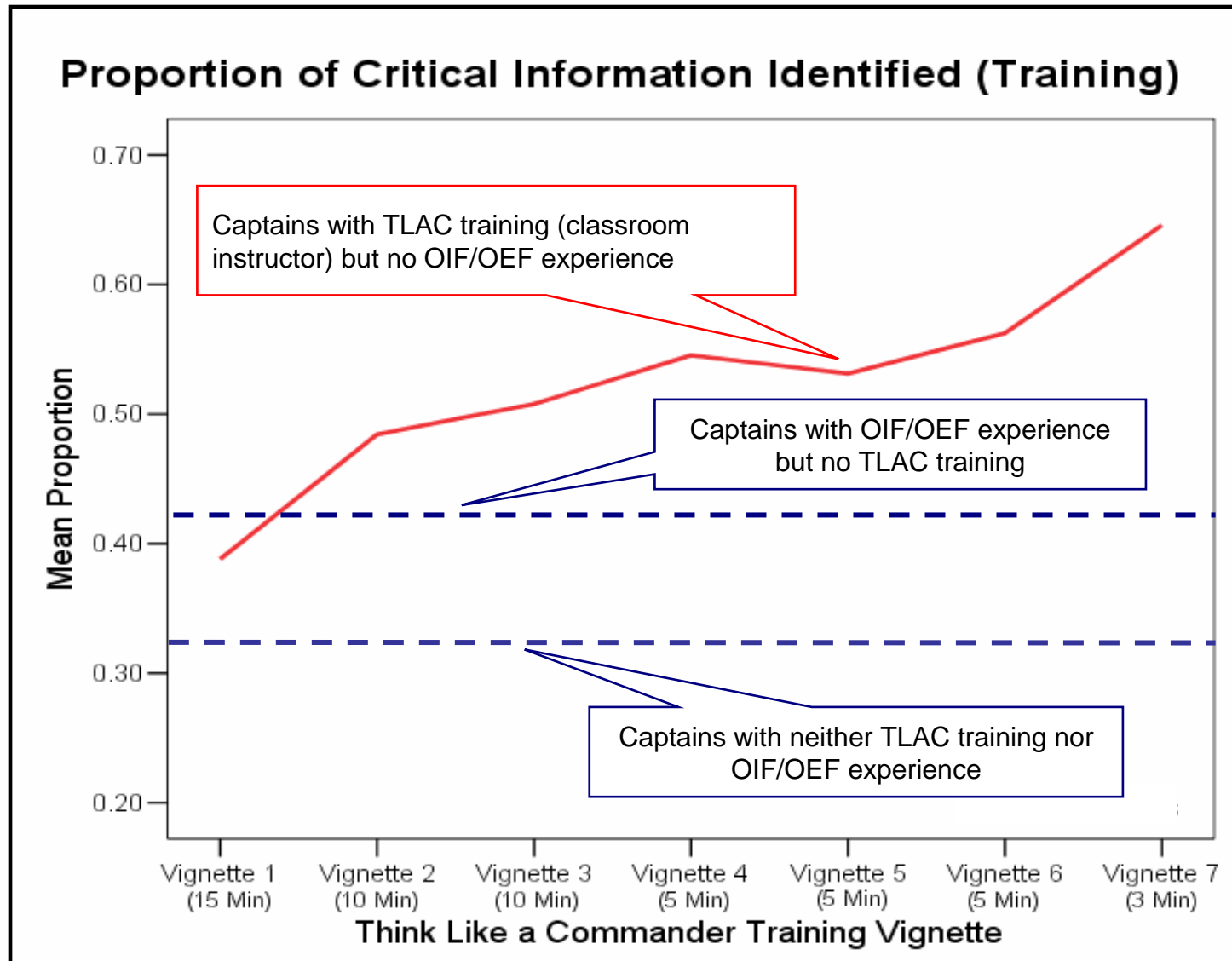
Proportion of Critical Information Identified (by Rank)



Focused Training in Adaptive Thinking

- **Participants included 24 Officers enrolled in the Armor Captains Career Course at Fort Knox, KY.**
- **None of the participants had OIF/OEF experience.**
- **Participants received about 8 hours of Think Like a Commander Training in addition to standard program of instruction.**

Training versus Experience



Take-away Points

- Training is different from Practice.
- Cognitive Skills can be Trained like any other behaviors.
- Practice and Experience without sufficient Training are inefficient and ineffective in the development of expertise.
- Creators of virtual media – games or simulations – should consider how well their products support the conduct of training as well as practice.

Questions?